

**U.S. FISH AND WILDLIFE SERVICE  
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Castilleja christii*

COMMON NAME: Christ's paintbrush

LEAD REGION: 1

INFORMATION CURRENT AS OF: April 26, 2010

STATUS/ACTION:

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: petitioned twice after the species was already a candidate (September 28, 1999; and February 19, 2002). Also petitioned to emergency list the species on February 22, 2002.

☐ 90-day positive - FR date:

☐ 12-month warranted but precluded - FR date:

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☒ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): December 15, 1980.

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or

continuation of candidate status.

- \_\_\_ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- \_\_\_ F – Range is no longer a U.S. territory.
- \_\_\_ I – Insufficient information exists on biological vulnerability and threats to support listing.
- \_\_\_ M – Taxon mistakenly included in past notice of review.
- \_\_\_ N – Taxon does not meet the Act’s definition of “species.”
- \_\_\_ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering Plants, Orobanchaceae (Broomrape)  
Family

*Castilleja christii* was previously included as a member of the family, Scrophulariaceae (Figwort family). In 1999, Judd et al. transferred all hemiparasitic members of the family Scrophulariaceae, including the genus *Castilleja*, into the family Orobanchaceae (Broomrape family). Although still listed as a member of the family Scrophulariaceae on the United States Department of Agriculture (USDA) Plants Database (<http://plants.usda.gov> 2010), this new treatment is consistent with some recent molecular work (cited in Judd et al. 1999) and we therefore recognize *Castilleja christii* as a member of the Orobanchaceae family.

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Idaho, Cassia County

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Idaho

LAND OWNERSHIP: *Castilleja christii* is confined to a single population at the summit of Mount Harrison south of Burley, Idaho in Cassia County. The population covers approximately 85 hectares (ha) (220 acres (ac)) of land managed exclusively by the U.S. Forest Service (Forest Service) Sawtooth National Forest, Minidoka Ranger District (formerly known as the Burley/Twin Falls Ranger District) in Idaho.

LEAD REGION CONTACT: Region 1 Regional Office, Linda Belluomini, 503-231-6283, [linda\\_belluomini@fws.gov](mailto:linda_belluomini@fws.gov)

LEAD FIELD OFFICE CONTACT: Idaho Fish and Wildlife Office, Kendra Womack 208-685-6951, [kendra\\_womack@fws.gov](mailto:kendra_womack@fws.gov)

#### BIOLOGICAL INFORMATION:

Species Description: *Castilleja christii* is a perennial forb, reaching 15 to 50 centimeters (6 to 20 inches) in height. Stems are erect, usually unbranched, and occur several in a cluster. The species has narrowly to broadly lanceolate leaves, with a showy inflorescence that is yellow to

yellow-orange with lanceolate to ovate bracts. *Castilleja christii* reproduces by seed but there is currently no information concerning seed dispersal or the seed bank. Plant growth begins around snowmelt, with peak flowering from July to mid-September.

**Taxonomy:** *Castilleja christii* was first collected by John Christ in 1950, followed shortly by William Baker in 1952 (Holmgren 1973). However, it was not recognized as a new species until 1973 when Noel Holmgren formally described it (Holmgren 1973). The U.S. Fish and Wildlife Service (Service) has carefully reviewed the available taxonomic information on this species and we consider it to be a valid taxon.

**Habitat/Life History:** *Castilleja christii* is endemic to subalpine meadow and sagebrush habitats found in the upper elevations of the Albion Mountains, Cassia County, Idaho between 2,621 and 2,804 meters (8,600 to 9,200 feet (ft)) (Mancuso and Kinter 2006). This species occurs primarily on gentle, northerly facing slopes. Deep snows on the occupied habitat may last until mid-July or August in some years. It is found in three distinct communities: snowbed, graminoid, and sagebrush/grassland habitat. The graminoid community has the highest density of *C. christii*, while the snowbed and sagebrush/grassland types have lower densities (Moseley 1993). The density of *C. christii* is inversely related to the density of sagebrush; it generally only occurs in openings between shrubs (Moseley and Hudak 1994, Moseley 1996). Associated species include mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Idaho fescue (*Festuca idahoensis*), Rocky Mountain goldenrod (*Solidago multiradiata*), alpine leafybract aster (*Symphyotrichum foliaceum*), silvery lupine (*Lupinus argenteus*), bearded wheatgrass (*Elymus caninus*), and slender wheatgrass (*Elymus trachycaulus*).

In 2002, Dr. Vince Tepedino, USDA Bee Biology and Systematics Laboratory, examined the pollinator ecology of *Castilleja christii* and the three other species of *Castilleja* that occur on Mount Harrison. Dr. Tepedino collected several native bee species visiting *C. christii*, including: *Megachile frigida*, *M. melanophaea*, and *Osmia grindeliae* (Vince Tepedino, Utah State University, *in litt.* 2002). In addition, ground nesting bees were documented in 2001 (K. Pierson, Sawtooth National Forest, pers. comm. 2001) as possible pollinators for *C. christii*.

All *Castilleja* species are considered hemiparasites (Shenk and Holsinger 2001, p. 3). Hemiparasites are able to form root associations with host plants and extract water, carbohydrates and alkaloids compounds from host plants. Long-term persistence of *C. christii* most likely depends on associations with native host plants (Motychak and Pierson 2005). Specific host species have yet to be identified for *C. christii*. Research on 12 specimens within each of the three habitat types (snowbed, sagebrush/grassland, and graminoid) on Mount Harrison was initiated during the summer of 2008 to identify host species. Although final results are not yet available, preliminary data suggests that probable native hosts include mountain big sagebrush, silvery lupine, Idaho fescue, and Rocky Mountain goldenrod (Pierson- Motychak and Motychak 2010, p. 6). In the snowbed communities, Rocky Mountain goldenrod is the most common plant species sympatric to *C. christii* and may be a host in that community.

Physical and Biological Factors (PBFs): Based on the preceding information, preliminary PBFs for *Castilleja christii* include (1) sufficient numbers of available and appropriate host species essential for the viability and reproductive success of *C. christii* individuals; (2) areas with relatively undisturbed soils with northern aspect above 2,600 meters (8,530 ft); (3) relatively undisturbed areas with a mix of native alpine snowbed, graminoid, and sagebrush communities; and (4) suitable insect visitors or pollinators for successful seed production. These preliminary PBFs are derived from the biological needs of *C. christii* as described in the preceding sections of this Candidate Notice of Review. They include those habitat components essential to the species, including suitable host availability, seed bank storage, seed germination and seedling growth, flower production, pollination, seed set and fruit production, and genetic exchange.

Historical Distribution and Current Distribution: The single population of *Castilleja christii*, which covers approximately 89 ha (220 ac), is restricted to the summit of Mount Harrison, the highest peak at the north end of the Albion Mountains in Cassia County, Idaho. Despite extensive searches within similar adjacent habitats, no other populations have been documented for the species (Moseley 1993). Survey and inventory work has been conducted for this species since its original discovery by John Christ in 1950. Holmgren (1973), in the original publication on *C. christii* stated, “I have searched in vain for this Harrison Mountain endemic in the neighboring mountain ranges as well as other peaks in the same range.” Shultz (1980) completed an extensive survey of the Burley Ranger District (Black Pine, Sublet, Raft River, and Albion Mountain Divisions) for plant species proposed for listing as threatened or endangered, specifically *C. christii*, but was unsuccessful in locating additional populations. In addition, Moseley (1993) surveyed Mount Harrison, the Independence Mountains, and Graham Peak, and failed to discover additional populations of *C. christii*.

Population Estimates/Status: The *Castilleja christii* population was initially thought to consist of approximately 10,000 individuals (Moseley and Hudak 1994). Subsequent estimates by Moseley (1996) suggested a much larger population. The most recent estimate, conducted in 2005, used distance sampling to estimate the overall population size for *C. christii*. Using this method, the 2005 population was estimated at 1,267,580 plants, with lower and upper confidence limits of 819,126 and 1,716,033 plants, respectively (Colket and Crymes 2006, p. 3). Despite the calculation of confidence limits, the 2005 population estimates should be interpreted with caution due to a limitation of distance sampling. Distance sampling requires that a minimum number of plants is present in each transect. To obtain the 2005 estimate, only transects containing greater than 100 plants were used, and the results obtained from the transects were then used to extrapolate the population size across the acreage known to be occupied by *C. christii* (Colket and Crymes 2006, p. 4). A current, accurate, estimate of the total population size is still lacking.

Monitoring: Monitoring of the *Castilleja christii* population on Mount Harrison was initiated in 1995 and has occurred in 1995 to 1997, 2000, and 2002 to 2009 (Pierson-Motychak and Motychak 2010, p. 3). Twenty permanent, randomly located monitoring transects, each 20 x 1 meter (60 x 3 ft), were originally established within the population. Two additional transects were added in 2002 in order to better monitor the disturbance on the edges of the *C. christii* population (Pierson-Motychak and Motychak 2010, p. 2). Transects are distributed in each of

the three habitat types (snowbed, graminoid, and sagebrush/grassland) and the number of plants and reproductive stems is measured across the entire 20 meter (60 ft) transect by joining one square meter (10.8 square ft) frames (Mancuso 2003). Photopoints have been established at each of the 22 transects. In 2002, the information recorded in the transects established for the population monitoring was expanded to include measurement of disturbance including off-road vehicle (ORV) use, livestock disturbance, invasive nonnative species disturbance, pocket gopher disturbance, and other unknown disturbances. The analysis of this monitoring has not been completed for the human caused disturbance recorded in these transects. Habitat monitoring also occurred in 1995, 2000, and 2002 utilizing 10 x 10 meter (30 x 30 ft) plots. Within these 10 meter (30 ft) square plots, all plants are identified and cover classes estimated for each (Mancuso 2003). Finally, the monitoring includes a 325 meter (1,066 ft) permanent transect, established in 1995, to monitor vegetation recovery from installation of an underground cable line that occurred at that time.

*Bromus inermis* (smooth brome) is also monitored using two methods. Each year the Forest Service maps the area of smooth brome that is chemically treated using GPS. This mapped area represents the distribution of smooth brome and provides an estimate of acres of infestation. In 2006, monitoring of smooth brome along permanent transects within the *Castilleja christii* population was also initiated by the Idaho Natural Heritage Program (INHP), and will continue in future years (Mancuso and Kinter 2007). The objective of this monitoring is to document whether efforts to control smooth brome at Mount Harrison are working over the long-term, and to determine if smooth brome and its control treatments are affecting *C. christii* abundance and its associated plant communities.

**Monitoring Results:** The Forest Service periodically submits monitoring reports to the Service. In 2005, a 10 year synthesis of monitoring results from 1995 to 2005 was submitted (Motychak and Pierson 2005) and in 2010, a follow-up report with results from 1995 to 2008 was received (Pierson-Motychak and Motychak 2010). Initially, data from 1995 to 1997 indicated a slight increase in both plant density (plants/square m) and reproductive output (flowering stems/plant) and the overall population was reported to be stable (Moseley 1998). However, between 1997 and 2004, *C. christii* plant density and reproductive output decreased by over 50%. Between 2004 and 2005, plant density and reproductive output both increased, although the population averages in 2005 were still less than half of those measured during the 1995-1997 sampling period. Since 2005, fluctuations in density and reproductive output have varied between the 3 community types, although data collected in 2008 show a slight increase for both density and reproductive output (Pierson-Motychak and Motychak 2010, p. 3). Monitoring was completed 2009. Preliminary analyses of these data indicate that the plant density and reproductive output are down slightly as compared with the 2008 data (K. Pierson, pers. comm. 2010)

Population fluctuations of *Castilleja christii* may be the result of a variety of factors, such as biological interactions, anthropogenic disturbances, and environmental effects (Motychak and Pierson 2005). Large annual fluctuations in plant numbers are reported to be typical for the species (Mancuso 2003). Correlations are low for the *C. christii* population density and both annual temperature and precipitation. However, correlations for *C. christii* reproductive stems/plant and temperature and annual precipitation are more significant; flowering decreases

with higher temperatures and increases with precipitation (Pierson-Motychak and Motychak 2010, p. 6).

A review of the 10 year monitoring results from 1995 to 2005 indicated that correlations are low between the fluctuations in the *C. christii* population and the density of invasive nonnative plant species, although the mean densities of invasives have more than doubled in each of the three community types between 2002 and 2005 (Motychak and Pierson 2005). Direct correlations between smooth brome and *C. christii* were not analyzed in the 2010 report. Further discussion about smooth brome and *C. christii* is included in the threats discussion below.

Smooth brome monitoring conducted by the INHP began in 2006 (Mancuso and Kinter 2007, p. 1) and was repeated in both 2007 and 2008. Baseline results from 2006 showed variable cover of smooth brome in all three community types (snowbed, graminoid, and sagebrush/grassland), indicating that the entire *C. christii* population is vulnerable to invasion by this nonnative species. Data collected in 2006, found lower cover ( $p < 0.05$ ) and frequency ( $p = 0.002$ ) of *C. christii* in snowbed community sites invaded with smooth brome versus non-invaded snowbed communities. However, no differences in cover of *C. christii* were detected in invaded versus non-invaded graminoid and sagebrush/grassland communities covering, 15 and 16 ha (37 and 38 ac) of the population, respectively (Mancuso and Kinter 2007, p. 6). These data suggest that *C. christii* may be more sensitive to the invasion of smooth brome in the snowbed community than the other two community types (Mancuso and Kinter 2007). *Castilleja christii* occurs at a low density in the snowbed community, while the graminoid community has the highest density of *C. christii* plants. Although final results from the 2007 and 2008 smooth brome monitoring have not yet been submitted to the Service, field data and general observations indicate that canopy cover of smooth brome is declining, while canopy cover of *C. christii* and other native species is remaining stable (Lynn Kinter, Idaho Natural Heritage Program, *in litt.* 2010).

Smooth brome treatment areas were mapped by the Forest Service in 2005, 2007, 2008, and 2009. Preliminary analyses of these data and GPS mapped boundaries from 2005, 2007, and 2008 indicate that the acres of infestation within the *Castilleja christii* population greatly decreased. GPS data from 2009 appears to indicate a spatial shift in the occurrence of smooth brome within the *C. christii* population, although there are some potential mapping inconsistencies. Data gathered in the upcoming (2010) field season will allow us to determine whether a shift has actually occurred, and to provide a more accurate description of the current distribution and acreage of smooth brome infestation within the population.

#### THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

##### *Development*

The largest loss of habitat within the range of *Castilleja christii*, estimated at 8 ha (20 ac), has been from past road developments and installation of underground powerlines prior to 1996 (Mancuso 1996). In 1997, the primary access road to the Mount Harrison summit, Howell

Canyon Road, was realigned and paved. Since this road bisects the *C. christii* population, some plants were directly impacted by construction or staging activities, although these impacts were relatively minor. Permanent plots were established in 1997 to monitor the direct impacts of the paving on the individuals nearest the road. Thirteen individuals were lost during the paving process. However, monitoring of these permanent plots in subsequent years (1998, 1999, and 2001) indicated that the number of individuals in roadside plots are stable or increasing (K. Pierson, *in litt.* 2002).

Indirect impacts also occurred, the most significant of which was the establishment of the nonnative grass species, smooth brome, which was introduced as part of the roadside revegetation mix. The distribution of this nonnative grass mainly follows the areas that were disturbed in the past for development of road beds or installation of electronic cable line routes (Motychak and Pierson 2005, Appendix 1). With the exception of the smooth brome invasion (see *Invasive Nonnative Plant Species* section below for more information), the level of threat resulting from past road development and paving are localized and historical in nature. Future road maintenance activities are anticipated to represent a low level threat due to the required presence of a Forest Botanist or qualified representative whose responsibility it is to avoid and minimize any impacts to *C. christii* plants. For example, a Forest Botanist was present throughout the 2007 chip sealing process and no plants were affected (USFS 2009, page 20).

#### *Invasive Nonnative Plant Species*

The invasion of nonnative plant species is currently considered the most imminent and significant threat to *Castilleja christii* and its habitat (USFS 2007, p. 33). Invasion by nonnative plant species alters the plant community composition and results in direct habitat loss and degradation for *C. christii*. Smooth brome, an aggressive, rhizomatous nonnative grass species, was first detected within the *C. christii* population in 1993 (Moseley 1993). In 1995, during the first year of population monitoring for *C. christii*, smooth brome was recorded on only 1 of 20 transects. However, following the 1997 roadside re-seeding, invasive plants, particularly smooth brome, increased in mean density and expanded several hundred feet from the paved roadside, sometimes forming dense monocultures that appeared to be excluding *C. christii* (USFS 2007; Mancuso and Kinter 2006; Motychak and Pierson 2005). By 2002 smooth brome was detected along 6 of the 20 monitoring transects (Motychak and Pierson 2005). Monitoring through 2004 included notes on nonnative plant species occurrence along the population monitoring transects; however, in 2002 the information recorded in the transects was expanded to include the collection of nonnative species data.

In response to the smooth brome invasion, the Forest Service and the Service initiated a long-term treatment plan in 2002 to eradicate smooth brome from the *Castilleja christii* population (USFS AND USFWS 2005). Initial hand pulling efforts in 2003 removed an estimated 3,627 kilograms (kg) (4 tons) of smooth brome. Further control efforts were conducted in 2004 by applying herbicide to the smooth brome via hand-wicking (Pierson 2004). However, the treatments in 2003 and 2004 were not successful at eliminating smooth brome in the *C. christii* population. According to data collected between 2002 and 2005, overall nonnative species density increased in the 3 plant communities where *C. christii* occurs (Motychak and Pierson

2010, p. 6). Prior to smooth brome treatment in 2005, smooth brome still persisted on 12 ha (30 ac), or approximately 15 percent of the population area of *C. christii* (Motychak and Pierson 2005, Appendix 1).

In 2005 the smooth brome on these 12 ha (30 ac) was treated with herbicide when plants were in the “boot stage” (prior to inflorescence development), followed by the hand removal of seed heads. Following the 2005 treatments, smooth brome plants showed signs of stress and large infestations appeared weakened. However, vegetation monitoring conducted after the 2005 treatments indicated that smooth brome still remained, with monitoring transects containing mean densities of 0.21, 0.19, and 0.12 smooth brome stems per square meter in the graminoid, snowbed and sagebrush communities, respectively. In 2006, smooth brome was treated again using the same methods employed in 2005. A much larger proportion of smooth brome plants produced seed heads following chemical treatment in 2006, than in 2005 (USFS 2007, p. 4). The treatment occurred 10 days later than in 2005 and may have allowed more individuals to produce inflorescence (USFS 2007, p. 4). In 2006, the INHP began a monitoring program to examine the effects of these treatments on the smooth brome and *Castilleja christii* and its habitat (Mancuso and Kinter 2007). Initial observations from the first year of monitoring confirmed that smooth brome was still widespread in the *C. christii* population despite 4 years of control efforts (Mancuso and Kinter 2007, p. 6).

Due to these unsatisfactory results, a more aggressive, multi-treatment control program was developed and implemented in 2007, 2008, and 2009. This approach includes 3 chemical treatments and 2 hand-pulling treatments (USFS 2009, p. 7). The Service does not currently have the final results from the 2007 and 2008 INHP smooth brome monitoring and therefore the success of the modified treatments cannot be quantified; INHP did not conduct smooth brome monitoring in 2009. However, field data and general observations indicate that canopy cover of smooth brome is declining, while canopy cover of *C. christii* and other native species is remaining stable (Lynn Kinter, *in litt.* 2010). Likewise, estimates from GPS mapped boundaries from 2005, 2007, and 2008 indicate that smooth brome infestation greatly decreased (K. Pierson, pers. comm. 2010). GPS data from 2009 appears to indicate a spatial shift in the occurrence of smooth brome within the *Castilleja christii* population, although there are some potential mapping inconsistencies.

Although these recent efforts appear to be moderately successful, the Service still considers the smooth brome infestation to represent the most significant threat to *Castilleja christii*, and long-term treatment will be required. In the Service’s 2009 Spotlight Species Action Plan for *C. christii* (Service 2009; [http://ecos.fws.gov/docs/action\\_plans/doc3075.pdf](http://ecos.fws.gov/docs/action_plans/doc3075.pdf)), the Service targeted reducing the smooth brome infestation to less than 2.8 ha (7 ac), or less than 3 percent of occupied *C. christii* habitat, with a decreasing trend over a 3 year period (Service 2009, p. 1). The Service and the Forest Service will continue to conduct smooth brome control efforts and monitor their efficacy, using the above target to measure overall success and the reduction of the threat.

Smooth brome poses a threat to *Castilleja christii* for several reasons. As stated above, invasion by nonnative plant species alters the plant community composition and results in direct habitat



loss and degradation for *C. christii*. Smooth brome is an aggressive, rhizomatous nonnative grass species and, since introduced, has spread throughout the *C. christii* population. In some cases, *Castilleja* species are known to opportunistically parasitize grasses (native and nonnative) and it is likely that smooth brome serves as a host for *C. christii* (Pierson-Motychak and Motychak 2010, p. 7). However, this association is not likely to be beneficial to the long-term fitness of the *C. christii* population on Mount Harrison. *Castilleja* plants are able to draw water and nutrients from grasses, but not alkaloids, as grasses do not produce them. Alkaloids from host species are essential for *C. christii* defense against herbivory and in pollination success. *Castilleja* plants parasitizing lupines (nitrogen-fixing, alkaloid-producing) are more attractive to pollinators and produce three times more seeds than *Castilleja* plants parasitizing grasses which are non-nitrogen fixing and non-alkaloid producing (Adler 2003).

Other nonnative, invasive plant species are also present in the *Castilleja christii* population. The density of these nonnative, invasive species such as *Agropyron sp.* (wheatgrass cultivar) and *Taraxacum officinale* (dandelion) increased along with the *C. christii* plant density between 2004 and 2005 (Motychak and Pierson 2005). Nonnative plant species transect data was not included in the 2010 monitoring report (Pierson-Motychak and Motychak 2010, p. 6). There are currently no active independent efforts to control nonnative plants; however, nonnative species located along the transects and any other nonnative plants encountered during the smooth brome control efforts are also chemically treated. A single plant of another invasive species, *Tanacetum vulgare* (tansy ragwort), was found within the *C. christii* population and removed prior to seed set by the Forest Service in 2006 and 2009 (USFS 2010, p. 13). The Forest Service proposes to survey for and remove this species as part of their ongoing monitoring efforts (USFS 2009, p. 14). Although we have documentation of other nonnative, invasive plant species within the *C. christii* population, the threat represented by these species is currently viewed as lower than the threat represented by smooth brome. These species do not appear to be displacing *C. christii* or its host plants to a significant degree at this time. Ongoing monitoring and nonnative species control efforts within the *C. christii* population will allow us to track the relative occurrence and potential threat of these species over time.

### *Recreation*

Habitat degradation from recreational impacts, including ORV travel, hiking, hang-gliding, picnicking, and camping is another threat factor affecting *Castilleja christii* (USFS 2007; USFS AND USFWS 2005). Although there is no designated trailhead at the summit, hikers often spend time at or near the lookout and walk through habitat occupied by *C. christii*. Such use can impact this species through trampling of plants, which could result in direct mortality or reduced reproduction. However, this impact appears to be of low magnitude and infrequent.

A hang glider launch site (100 square meters (1,096 square ft)) is within the occupied habitat boundary for *Castilleja christii*. The increased use of the hang glider launch site could potentially impact individuals, the viability of the population, habitat quality, and contribute to soil compaction and erosion in occupied habitat. In addition, the hang glider site and associated activities could be a vector for the introduction of invasive plants. Hang gliders travel from many states and regions to participate in activities on Mount Harrison; noxious weeds and

nonnative species could be transported from other areas. Individual hang gliders are not required to obtain a permit for launching. However, a local hang gliding group applies annually for a non-commercial special use permit for a fly-in event (permit required for greater than 75 people in attendance). Under the permit authority (36 CFR 251.54), conditions can be added to the permit to ensure resource protection. As part of the annual permit, education of the group and monitoring efforts by Forest personnel are required and appear to reduce impacts in occupied habitat. Appropriate action (denial of special use permit) would be taken if permittees fail to prevent impacts at annual events. To date, all permittees have been compliant with the conditions of the permit and no changes have been necessary.

Several unimproved roads, which are used to access camping and hang-gliding launch sites, are found within the *Castilleja christii* population. In 2008, the Forest Service implemented new travel plans that restrict motor vehicles to designated routes only, which closed 47 hectares (16 ac) of the *C. christii* population previously open to cross-country travel (USFS 2010, p. 29). Despite these restrictions, unauthorized ORV use has been reported in the *C. christii* population. Impacts associated with ORV use result in loss of the plant's habitat through soil erosion and mortality of individuals. Prior to 2005, the Forest Service had installed an estimated 3.2 kilometer (km) (2 miles (mi)) of rock barriers along most roadways running through the *C. christii* population in an effort to control damage from unauthorized ORV use (Pierson 2004). However, the 2005-2006 report for the implementation of the Candidate Conservation Agreement (CA) for this species indicated that two unauthorized vehicles were observed in the *C. christii* population in 2006 (USFS 2007, p. 7). Additionally, large ruts up to 30 centimeters (12 inches) deep, caused by unauthorized vehicles were recorded within the population in 2007 and 2008 (USFS 2009, p. 7). In 2009, many more signs of trespass, particularly along the electronic site road, were observed. The Forest Service has placed large rocks in several areas to prevent vehicles from entering the population; however, some trespass use has continued to occur. In an effort to control this unauthorized ORV use, the Service provided funding to the Forest Service to install a new gate at a pinch point on the main access road above Lake Cleveland. The Forest Service installed the base for the gate in 2009 and will install the gate in early spring of 2010 (USFS 2010, p. 29).

During the winter, snowmobile use is frequent in the area which is accessible from a designated winter parking area located a few miles from the summit of Mount Harrison. Winter use in the area has not been monitored, thus it is not known if this activity is impacting habitat for this species, particularly along areas of receding snow (USFS AND USFWS 2005).

In an effort to educate the public about recreational use impacts affecting *Castilleja christii* and its habitat, an interpretive area with numerous signs was installed near the summit of Mount Harrison in July 2004, and supplemented with eight small interpretive signs in 2007 (Pierson 2004; USFS 2009, p. 6). The purpose of these signs is to inform the public and promote conservation of the species, describe area closures to off-road and off-trail travel, and to prevent recreational use within the population area. The Forest Service also continues to periodically conduct outreach activities with user groups such as hang-gliders.

The Forest Service will continue to monitor for signs of unauthorized use and use adaptive management to further help prevent unauthorized travel off of designated roads and trails (USFS 2010, p. 6) and population monitoring will continue to provide information on the impact to *C. christii* from recreational activities and whether these threats have been reduced or eliminated. Based on current information and the continuing efforts of the Forest Service to minimize or eliminate the impacts associated with vehicle and recreation based disturbances, we believe this is a low level threat.

#### *Conclusion for Factor A*

Based on our evaluation of the on-going risk to *Castilleja christii* from habitat modification resulting from smooth brome invasion and other factors listed above, we conclude that there is sufficient information to develop a proposed listing rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range.

#### B. Overutilization for commercial, recreational, scientific, or educational purposes.

There are some limited observations of collections of *Castilleja christii* for bouquets and other personal use; however, overutilization is not considered to be a threat factor at this time.

#### C. Disease or predation.

##### *Disease*

Disease is not known to be a threat factor for *Castilleja christii*.

##### *Livestock Use*

In the past, mortality due to unauthorized livestock grazing (i.e., predation as considered under factor C), was considered a threat to *Castilleja christii*. Livestock grazing can adversely affect *C. christii* by trampling and/or consuming plants and could result in reduced reproductive success or direct mortality (USFS AND USFWS 2005). The summit of Mount Harrison has been closed to livestock grazing for over 20 years; however, in some years the area is subject to occasional unauthorized livestock use. In an effort to prevent this unauthorized use within the *C. christii* population, the Forest Service initially installed approximately 7 km (4.3 mi) of fence (Pierson 2004). Very few incidents of unauthorized livestock use have occurred within the *C. christii* population since that time; no unauthorized use was reported from 2005 to 2007. Two occasions were reported in 2008 (Lucas Phillips, Sawtooth National Forest, pers. comm. 2009; USFS 2009, p. 6), and prompt action to both remove livestock and install additional fences were taken. No new livestock grazing was reported in 2009 (USFS 2010, p. 6).

The lookout person atop Mount Harrison has been instructed to report all unauthorized use by livestock within the *C. christii* population. If unauthorized use is observed, permittees are notified immediately and the unauthorized cattle are quickly removed (USFS 2010, p. 17). In addition, annual meetings with livestock permittees include discussions of conservation actions

for the species including continued efforts to prevent unauthorized use by livestock grazing. Given this prompt and active management of unauthorized livestock use by the Forest Service and the lack of livestock trespass in 4 out of the past 5 years, we believe that livestock impacts only constitute a low level threat to *C. christii*.

D. The inadequacy of existing regulatory mechanisms.

*Castilleja christii* has been considered a sensitive species by the Forest Service's Regional Forester (Region 4) since 1980. The objectives of management for such species, as described in the Sawtooth National Forest Plan (Forest Plan), are to ensure their continued viability throughout their range on National Forest lands, and to ensure that they do not become threatened or endangered under the Endangered Species Act because of Forest Service actions (USFS and USFWS 2005). The Forest Plan currently contains land management standards and guidelines for candidate species including *C. christii* (USFS 2003). It also includes forest-wide direction and management area direction designed to prevent or mitigate impacts to this species and its associated habitat.

In 1996 the Mount Harrison Research Natural Area (RNA) was established. This RNA includes approximately 23 percent of the *Castilleja christii* population. The RNA designation allows for the exclusive management of the land within its boundaries in an undisturbed state. In 1998 the *Castilleja christii* population and the RNA were included in a mineral withdrawal from National Forest System lands to prevent mining claims in the area. This withdrawal designation will continue until 2018, at which time it will be re-evaluated for renewal (Pierson 2004, USFS and USFWS 2005). In 2003, the Mount Harrison Botanical Special Interest Area (BSIA) was established. This BSIA includes 142 ha (350 ac) and provides protection to the remaining 77 percent of the *C. christii* population located outside of the RNA. The BSIA is managed to conserve a botanical resource in conjunction with other land uses. While a BSIA designation may normally provide a lesser level of protection for the *C. christii* population than an RNA designation, in this instance it has resulted in an increased level of protection for *C. christii* from its previous status of no special protection. Together, the BSIA and RNA established the framework to provide protection of this species while carrying out land management activities on the summit of Mount Harrison.

Following the expiration of a 1995 CA for *Castilleja christii* in 2000, the Service and the Forest Service completed and signed a new CA in 2005. An appendix of the 2005 CA describes the links between the forest-wide management direction in the Forest Plan with potential and existing threats to *C. christii* (USFS and USFWS 2005). The CA also calls for the completion of a management plan for the BSIA, which would outline additional protection measures and describe appropriate activities for the BSIA, management actions and needs (e.g., nonnative plant species treatment, increased signing), and would outline management objectives to maintain the botanical characteristics for which it was established. The BSIA management plan was scheduled to be completed by fall 2005; however, the Forest Service has not yet completed the management plans for either the RNA or the BSIA.

The Forest Service travel plans currently restrict motor vehicles to designated routes within the *Castilleja christii* population (USFS 2010, p. 7) and the summit of Mount Harrison has been closed to livestock grazing for over 20 years. Although most of the ground disturbing threats to this species have been minimized through these restrictions as well as through the implementation of past and existing conservation agreements, some trespass has been documented. However, the Forest Service continues to implement actions to reduce impacts from these unauthorized uses and based on the most recent CA annual report (2010), current management of these issues by the Forest Service is active and adequate (USFS 2010).

E. Other natural or manmade factors affecting its continued existence.

*Genetic Diversity and Hybridization*

Hybridization of *Castilleja christii* with other species of *Castilleja* in the Albion Mountains may be occurring. Cross-visitation by a known pollinator, the leaf-cutting bee (*Megachile frugida*), has been documented (Vince Tepedino, pers. comm. 2002), and potential intermediate hybrids between *Castilleja* species have been observed on Mount Harrison. Two potential hybrid plants were recorded in the 2006 long-term population monitoring transects (USFS 2007, page 16), and plants considered hybrids were recorded in the line distance sampling conducted in 2006 (Mancuso and Kinter 2007). In 2007, 2008, and 2009, the amount of potential hybrids recorded along the long-term population monitoring transects varied with 70, 7, and 40 potential hybrids recorded respectively (USFS 2009, page 9). *Castilleja christii* is already at risk of losing its genetic integrity as a species as a result of its small population distribution, and the threat of hybridization may pose an additional conservation concern for this species. Hybridization, if occurring, represents a potential threat to *C. christii* due to the potential for genetic dilution, eventual swamping, and loss of the pure species of *C. christii*.

In 2008, J. Mark Egger, a taxonomic expert on *Castilleja spp.* at the University of Washington Herbarium, assessed over 30 specimens of *Castilleja christii* for possible hybridization within the population. Results indicated that none of the specimens examined were likely hybrids (J. Mark Egger, University of Washington Herbarium, pers. comm. 2008). Furthermore, Mr. Egger noted that limited F1 hybridization is not unusual in *Castilleja* and that if the specimens sent were representative, “such cases are very few and probably limited to peripheral habitats”. Based on information currently available, hybridization appears to represent a low level threat to *C. christii*. In April 2009, a graduate student from Boise State University proposed further research on possible hybridization entitled “Exploring Putative Hybridization in an Endemic Species of Paintbrush, *Castilleja christii* (Orobanchaceae): Utilizing Morphological and Molecular Markers”. This work may help us better understand the potential for, occurrence of, and impacts of hybridization between *C. christii* and other sympatric species of *Castilleja*. We anticipate the results of this work will be available within the next year.

*Wildfire*

There has been little if any impact from fire on top of Mount Harrison in recent years. The effects of direct impact from fire to *Castilleja christii* are currently unknown but are estimated to

be low because the soils generally remain moist well into August. Due to the lack of fuels in occupied habitat, fire is not expected to be hot enough to destroy the underground root structure of *C. christii* or its host plants.

### *Climate Change*

The Intergovernmental Panel on Climate Change (IPCC) has concluded that warming of the climate is unequivocal and that continued greenhouse gas emissions at or above current rates will cause further warming (IPCC 2007). The FWS is currently developing interim guidance regarding relevant aspects of the Endangered Species Act implementation involving climate change, with a focus on how to evaluate and include the best available scientific information in our decision-making. While we recognize that climate change may affect *Castilleja christii* populations, we currently lack information that can be applied at the site-specific scale with which to evaluate its potential impact, or the extent to which it may pose a threat to the species.

### CONSERVATION MEASURES PLANNED OR IMPLEMENTED

There have been 2 CAs between the Forest Service and the Service for *Castilleja christii*. The first CA was completed in 1995 and expired in September 2000. This CA focused on actions necessary to protect habitat for *C. christii* and to stabilize the species' population (USFWS 1995). The Forest Service showed progress on conservation efforts when the CA was current and they continued those efforts after the expiration of the CA. Many of the action items defined in the 1995 CA are still ongoing today. For example, monitoring established with this original CA is still ongoing (Motychak and Pierson 2005, Pierson 2007). A Conservation Assessment and Strategy for *C. christii* was prepared by the Forest Service in 2002 and this was incorporated into the Sawtooth National Forest Plan (Forest Plan) by reference in 2003 (USFS 2002, USFS 2003).

The Service and the Forest Service completed a new CA for *Castilleja christii* in 2005. This CA tiers to the Forest Plan, which contains specific protections for Threatened, Endangered, Proposed, Candidate, and Sensitive species (USDA Forest Service 2003). The Forest Service and Service committed to continue working together to conserve *C. christii*, and the current CA continues many of the same proactive, ongoing, land management actions and responsibilities included in the CA that expired in 2000 (USFWS 1995). The new CA expands the existing actions and includes new actions to detect and control invasive species, provides outreach to public and user groups, and includes additional effectiveness monitoring and management involvement. In total, 51 agency responsibilities and conservation actions are specified in the CA, as well as tasks, performance metrics, thresholds, management response, and reporting requirements for 18 of the 51 actions. The anticipated timing, funding estimates, and the responsible parties for implementing conservation actions and tasks are also identified (USFS and USFWS 2005). A complete analysis of the actions in this CA under the Service's Policy for Evaluating Conservation efforts (PECE) has not yet been conducted. Actions that have been initiated have been discussed in the appropriate Threats analysis section herein.

The Mount Harrison Research Natural Area (RNA) was established in 1996, and encompasses

23 percent of the *Castilleja christii* population (Moseley and Hudak 1994). The RNA is located to the east of, and directly adjacent to, the existing access road that leads to the summit of Mount Harrison. The majority of the *C. christii* population occurs immediately west of the road. The Forest Service did not expand the RNA to include this area because the presence of roads and structures was not considered to be compatible with the goals or management of an RNA. Instead the Forest Service established the Mount Harrison Botanical Special Interest Area (BSIA) in 2003, which includes the remaining 72 percent of the *C. christii* population not contained within the RNA (Pierson 2004, USFS 2003, USFS and USFWS 2005). A BSIA is managed differently than an RNA since it is designed to conserve a botanical resource in conjunction with other land uses, while an RNA is managed exclusively for the conservation of the land in an undisturbed state. However, these designations combined have resulted in an increased level of protection for *C. christii* from its previous status of no special protection. Development of a management plan for the BSIA is identified as a conservation action in the new CA, but has not yet been initiated (USFS and USFWS 2005, USFS and USFWS 2007). In 1998, the *C. christii* population, and the adjacent RNA, was included in a mineral withdrawal from National Forest System lands to prevent mining claims in the area. This withdrawal designation will continue until 2018, at which time it will be re-evaluated for renewal (Pierson 2004, USFS and USFWS 2005).

In 2004, the Mount Harrison Interpretive Area (defined as the RNA and the BSIA) was dedicated. This area is comprised of a tri-panel kiosk and seven smaller interpretive signs designed to encourage the conservation of *Castilleja christii* (Pierson 2004, USFS 2009, p. 6). In 2007 additional interpretive signs were also installed. All of these interpretive materials are intended to educate users and visitors about the *C. christii* population and to outline rules and recommendations for use of the Mount Harrison area. The materials provide information on reducing impacts, as well as discussing the biology of the species, and the history of conservation efforts (i.e., monitoring, meeting with special user groups, rock barriers, and invasive species eradication efforts). Additional outreach to user groups, such as hang-gliders, continues to occur periodically (USFS 2010, p. 4).

In an effort to control damage from ORV use, during the course of the last 6 years the Forest Service has placed large rocks along most roadways running through the *Castilleja christii* population. The Forest Service also signed a Travel Plan decision that changed cross-country use to designated routes only. Unauthorized ORV use in 2007, 2008, and 2009 also lead to the installation of a new gate to prevent access into this area until the snow has melted, which will be completed in 2010 (USFS 2010, p. 29).

Livestock grazing was administratively excluded from the summit of Mount Harrison upon establishment of the RNA (Mancuso and Evenden 1996). Since this administrative closure, however, occasional unauthorized livestock use has occurred in the area. In an effort to prevent this unauthorized use, the Forest Service has installed over 9 km (5.6 mi) of fence (Pierson 2004; USFS 2010, p. 17). Additionally, the fire lookout person atop Mount Harrison has been instructed to report all unauthorized livestock use within the population. Annual meetings with livestock permittees include discussions of conservation actions for the species including continued efforts to prevent unauthorized livestock grazing. Only two instances of trespass were

documented in the past 5 years, both in 2008 (USFS 2009, p. 6). The Forest Service will provide additional rock and fence barriers if seasonal ORV and cattle trespass threats continue and are confirmed. Upkeep of fences and an assessment of fence effectiveness may be needed in the future.

In response to the smooth brome invasion into the *Castilleja christii* population, the Forest Service and the Service initiated a long-term treatment plan (USFS and USFWS 2005). Initial efforts in 2003 included hand pulling to remove smooth brome from the population. From 2003 to 2006 herbicide was applied to the smooth brome, with both the 2005 and 2006 herbicide treatments followed by hand removal of seed heads. A monitoring program to examine the effects of these treatments on the smooth brome and *C. christii* and its habitat began in 2006 (Mancuso and Kinter 2006, p. 1) and based on the results, treatments were modified in 2007, 2008, and 2009 to include three chemical treatments and two hand-pulling treatments (USFS 2009, p. 7). Initial monitoring indicates that these more aggressive treatments were more successful in controlling smooth brome than previous efforts (Lynn Kinter, in litt. 2010). Both the smooth brome treatments and monitoring programs are expected to continue in the future.

In areas that were successfully treated, dead, brown thatch remains where larger patches of smooth brome were eliminated. In an effort to ensure that these areas are not reinvaded by smooth brome or other nonnative invasive species, the Forest Service initiated a grow-out program through a partnership with Red Butte Garden, a non-profit botanical center affiliated with the University of Utah in Salt Lake City. *Castilleja christii* seedlings, as well as seedlings of other common native grasses and forbs found on Mount Harrison, were grown from locally collected seed in 2008. In 2009 over 1800 plants were planted back into their native habitat on Mount Harrison, including 8 *C. christii* plants (USFS 2010, p. 30). The *C. christii* grow-out and out-planting program is being continued in 2010, with an emphasis on increasing *C. christii* seedling survivorship.

In accordance with the 1995 CA, the Denver Botanical Garden maintains an off-site seed storage program. Approximately 3,000 seeds are in seed storage at the National Seed Storage Laboratory in Fort Collins, Colorado (IDFG 2010). The 2005 CA called for additional seed collections to be made. Although seeds were collected for the grow-out program (see above), we are unsure if additional *Castilleja christii* seeds are being stored.

## SUMMARY OF THREATS

Threats to *Castilleja christii* and its associated habitat include invasive nonnative plants, especially smooth brome; recreational activities, including ORV use, campers, hikers, picnickers, and hang gliding; trespass cattle; road construction and maintenance; and naturally occurring impacts. Many of these threats are being ameliorated by the Forest Service.

The placement of rocks and fencing appears to have reduced the threat of ground disturbing impacts (e.g. ORV use and unauthorized livestock grazing) for most of the Mount Harrison summit area. Many of these impacts are seasonal, occurring during the late-spring and summer periods when the plant is flowering. Unauthorized vehicles were observed within the population



in 2006 (USFS 2007, p. 33), and large vehicle tracks were recorded in 2007 and 2008. In 2009, many more signs of trespass, particularly along the electronic site road, were observed. To address this unauthorized ORV use, the Service and the Forest Service cooperated to purchase and install a new gate to prevent access into this area until the snow has melted; installation should occur in 2010 (USFS 2010, p. 29). Based on the continuing efforts of the Forest Service to minimize or eliminate the impacts associated with vehicle and recreation based disturbances, we believe this is a low level threat. Likewise, due to the recent and planned construction of strategic fencing around the *Castilleja christii* population to controlled unauthorized livestock use near the summit of Mount Harrison and the lack of unauthorized livestock use in four out of the past five years, we consider livestock grazing to pose a low level threat to *C. christii* and its habitat.

Hybridization of *Castilleja christii* with other species of *Castilleja* in the Albion Mountains may be occurring, as cross-visitation by a known pollinator has been documented and potential intermediate hybrids between *Castilleja* species have been observed on Mount Harrison. Over 30 specimens of possible hybrids were sent to the University of Washington Herbarium in 2008 for further evaluation. Results of this evaluation indicated that the degree of hybridization that is occurring is likely low and limited to peripheral habitats (J. Mark Egger, pers. comm. 2008). Based on this information, hybridization appears to represent a low level threat to *C. christii*. Further research being conducted through Boise State University will provide additional information about the potential degree of hybridization and how it could be affecting this species.

Past road development and installation of underground powerlines opened up disturbed areas for invasive, nonnative plants. Subsequent to this disturbance, increasing invasive plant numbers and aerial extent were documented in the *Castilleja christii* habitat area. The most imminent and severe threat to *C. christii* is the smooth brome invasion and displacement of native host plants. Despite repeated control efforts and recent improvements in treatment effectiveness, smooth brome is still located throughout the *C. christii* population. Although eradication efforts are ongoing and recent monitoring suggests that the modified treatments initiated in 2007 have been more effective at reducing the infestation (Lynn Kinter, in litt. 2010), smooth brome continues to pose an ongoing threat to the habitat of *C. christii* due to the restricted distribution of the species and the invasive nature of smooth brome. Therefore, the invasion of nonnative plant species is currently considered the most imminent and significant threat to *C. christii* and its habitat.

Based on our evaluation of the on-going risk to *Castilleja christii* from habitat modification resulting from smooth brome invasion, we conclude that there is sufficient information to develop a proposed listing rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range. At this time, based on the best available information, we continue to find that the species meets our definition of a candidate primarily due to the threat factors described in factor A.

We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

\_\_\_ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

## RECOMMENDED CONSERVATION MEASURES

The Service completed a Spotlight Species Action Plan for *Castilleja christii* in 2009. This plan was developed to identify conservation goals and tasks that are needed to improve this species' conservation over the next several years. This plan can be found on the Service's website at: [http://ecos.fws.gov/docs/action\\_plans/doc3075.pdf](http://ecos.fws.gov/docs/action_plans/doc3075.pdf)

Conservation measures recommended for *Castilleja christii* include expanding the knowledge on the genetics of the species and its hosts, continuing treatment and monitoring of smooth brome, continuing population monitoring of *C. christii* and its habitat, and restoring habitat where smooth brome has been treated. A brief list of recommended *C. christii* conservation measures is as follows; a full discussion of these measures is provided in the CA (USFS and USFWS 2005) which is incorporated herein by reference.

- (1) Continue to fully implement the 2005 CA.
- (2) Continue population genetic analysis of *C. christii*, including a direct phylogenetic comparison to all other species of the genus *Castilleja* on Mount Harrison to evaluate hybridization (USFS 2007).
- (3) Continue research to identify the native plant host(s) (especially alkaloid producers) of the parasitic *C. christii*.
- (4) Reseed native forbs and grasses that are locally and genetically adapted to Mount Harrison summit in areas treated to control smooth brome.
- (5) Pursue alternate types of smooth brome control that would further minimize its impact on the native plant community on Mount Harrison (USFS 2007, p. 34).
- (6) The Service, Forest Service and the State of Idaho should continue to work together to reduce the ongoing threat from smooth brome to *C. christii* and its habitat.
- (7) Continue monitoring smooth brome and *C. christii* prior to annual smooth brome control efforts. Future monitoring of smooth brome treatments should also add a means to assess if native plant species are establishing where control treatments may have left patches of dead smooth brome thatch within the *C. christii* population (Mancuso and Kinter 2007, p. 8).

## LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
<b>Moderate to Low</b>	<b>Imminent</b>	Monotypic genus	7
		<b>Species</b>	<b>8*</b>
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

### Rationale for listing priority number:

#### *Magnitude:*

The Service considers the invasion of nonnative plant species to be the primary threat to *Castilleja christii* and continues to consider the magnitude of this threat to be moderate. The Forest Service and the Service are committed to controlling smooth brome until control efforts are successful. Although control efforts conducted in 2005 and 2006 were not effective in reducing the smooth brome infestation, results from 2007 to 2009 monitoring suggest that modified treatments that increased chemical applications and hand removals have been more effective at reducing the infestation (Beth Colket, Idaho Department of Fish and Game, pers. comm. 2009; USFS 2009, p. 7; Lynn Kinter, in litt. 2010).

The Idaho Natural Heritage Program (INHP), and the Idaho Native Plant Society (INPS) recently recommended that we characterize the magnitude of the threat to *Castilleja christii* from smooth brome as high because of the tendency for populations of invasive species to grow exponentially until all available habitat is exploited (Lynn Kinter pers. comm. 2007; INPS 2007a, 2007b). We concluded that such a change is unsupported at this time because we lack evidence that the population of smooth brome is expanding at an exponential rate. In 2005, 2006, and 2007, 15, 17.5, and 6 ha (30, 35, and 15 ac) respectively, were occupied by smooth brome and treated within the *C. christii* population. In addition, it appears that the effectiveness of the treatment methods employed in 2007 and 2008 improved and observations from field personnel indicate that it has been substantially reduced (Beth Colket, pers. comm. 2009; USFS 2009, p. 7; Lynn Kinter, in litt. 2010). Results of smooth brome treatments in 2009 are currently uncertain, as

there appears to have potentially been some discrepancy in GPS mapping of the smooth brome boundaries. We expect to have more information following the 2010 treatments and mapping.

This recommendation to reclassify the magnitude of threat as high was also based on the presence of potential hybrids documented in 2006 monitoring and the presence of new invasive, nonnative plant species in the population (INPS 2007b). However, the recommendation of the INPS does not take into account the Service's consideration of conservation efforts and the reduction of threats to the species that are ongoing as a part of the CA. In addition, the results from an assessment of 30 specimens to determine the extent of hybridization within the population indicated that none of the specimens examined were likely hybrids (J. Mark Egger, pers. comm. 2008). Further hybridization research was initiated in April 2009, by a graduate student from Boise State University. Results from this research will be used to re-evaluate the potential threat from hybridization.

*Imminence:*

The Service continues to consider the primary threat level to *Castilleja christii* to be imminent. Within *C. christii* occupied habitat, the density of smooth brome increased between 2002 and 2006. Revised treatments in 2007, 2008, and 2009 appear to have substantially reduced the infestation, but have not eradicated it. Therefore, the threat from smooth brome still persists, and is considered imminent. As stated above, threats from recreational use (e.g., ORV use, hiking, hang-gliding) and trespass livestock are occasional, and occur seasonally during the late-spring and summer periods when the plant is flowering. Current Forest Service management of the Mount Harrison summit appears to be responsive to addressing the impacts from occasional unauthorized recreational use and livestock trespass. However, we also consider these threats imminent because they have not been totally eliminated and have occurred in the past two years. In addition, because *C. christii* is endemic to a single location in southern Idaho, threat factors as described in this document pose an imminent threat to the population due to its restricted habitat and small population size.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No, the moderate magnitude of threats precludes the need for emergency listing at this time. Some threats to the species (ORV impacts and other recreational impacts), although they have not been totally eliminated, are only occasional, occur seasonally, and are being addressed through conservation measures in the 2005 CA (e.g., fencing, rock barriers, educational signage). Many of these measures were initiated prior to the 2005 CA. Our ranking of moderate magnitude reflects the recent and aggressive actions undertaken by the Forest Service to address and minimize or eliminate threats to this species. For example, the threat from smooth brome to the persistence of *Castilleja christii*, although still imminent, is being dealt with aggressively by the Forest Service and Service. The CA provides for continued conservation actions and creates new tasks to assess the effectiveness of efforts to reduce the threats to the species through 2015.

## DESCRIPTION OF MONITORING:

The single localized population of *Castilleja christii* occurs on lands managed exclusively by the Forest Service (Sawtooth National Forest) in Idaho, which facilitates the coordination and assessment of the species. The Service coordinates regularly with the Forest Service on *C. christii* conservation and management efforts, participates in the yearly population monitoring and smooth brome control, and processes contracts and grants to assist with funding conservation actions and monitoring. The Service also meets with the Forest Service annually to review the implementation of the CA and review the results of population monitoring studies and other conservation efforts. Ongoing cooperative projects including the interpretive signs, nonnative plant control, and updating the CA require constant informational exchange.

Population, habitat, and threats monitoring has occurred from 1995 to 1997, in 2000, and from 2002 to 2009 (Pierson-Motychak and Motychak 2010, p. 3). The Forest Service has submitted annual progress reports to the Service and has completed two monitoring reports analyzing the *Castilleja christii* population data. Distance sampling was initiated in 2005, to attempt to obtain a more rigorous estimate of total population numbers than may be possible with the long-term monitoring plots (Colket and Crymes 2006). In addition, monitoring of smooth brome in the *C. christii* population was initiated in 2006, and will continue in future years. The objective of this monitoring is to document whether efforts to control smooth brome at Mount Harrison are working over the long-term, and to determine if smooth brome and its control treatments are affecting *C. christii* abundance and its associated plant communities (see the *Population Estimates/Status, Monitoring, and Monitoring Results* sections above for a summary of the monitoring results).

Because of the limited species distribution, and the few responsible agencies and species experts, we believe this level of monitoring is adequate at this time to update the status of the species.

## COORDINATION WITH STATES:

The Idaho Natural Heritage Program, formerly the Idaho Conservation Data Center (CDC), has been involved in an ongoing dialogue with the Service on monitoring and assessment of this species. They conducted a status review in 1993; designed the population, habitat, and threats monitoring; and have conducted population and habitat monitoring with the Forest Service and Service since 1995. They received funding through Section 6 for population monitoring of *Castilleja christii* in 2005, and the smooth brome monitoring in 2006 (see *Population Estimates/Status, Monitoring, and Threats* sections above). The INHP provided information to the Service on the current status of *C. christii* in 2007 and comments on a draft of the Threats section (Lynn Kinter, pers. comm. 2007).

## LITERATURE CITED

- Adler, L.S. 2003. Host species affects herbivory, pollination and reproduction in experiments with parasitic *Castilleja*. *Ecology*. 84(8):2083-2091.
- Colket, B. and G. Crymes. 2006. Estimating the abundance of Christ's Indian paintbrush, (*Castilleja christii*) using distance sampling methodology. Idaho Conservation Center and Idaho Department of Fish and Game, U. S. Fish and Wildlife Service, Boise, Idaho.
- Holmgren, N.H. 1973. Five new species of *Castilleja* (Scrophulariaceae) from the Intermountain Region. *Bulletin of the Torrey Botanical Club*. 100: 83-93.
- (IPCC) Intergovernmental Panel on Climate Change. 2007. Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- (IDFG) Idaho Department of Fish and Game. 2010. Idaho Department of Fish and Game, Idaho Natural Heritage Program Website. Available online at: [http://fishandgame.idaho.gov/cms/tech/CDC/spp\\_accounts\\_plants/caschr.cfm](http://fishandgame.idaho.gov/cms/tech/CDC/spp_accounts_plants/caschr.cfm). Last accessed May 4, 2010.
- (INPS) Idaho Native Plant Society. 2007a. Results of the twenty-third annual Idaho rare plant conference sponsored by the Idaho Native Plant Society February 13-14, 2007, Boise, Idaho.
- (INPS) Idaho Native Plant Society. 2007b. Notes from the discussion on *Castilleja christii* in, results of the twenty-third annual Idaho rare plant conference sponsored by the Idaho Native Plant Society February 13-14, 2007, Boise, Idaho.
- Mancuso, M. 1996. Species account: *Castilleja christii*. Prepared by the Idaho Department of Fish and Game's Conservation Data Center, Boise, Idaho. April 25, 1996. 6 pp.
- Mancuso, M. 2003. A fifth year of monitoring Christ's Indian paintbrush (*Castilleja christii*) on the Sawtooth National Forest: 2002 results. Prepared by the Idaho Department of Fish and Game's Conservation Data Center, Boise, Idaho. April 2003. 17 pp.
- Mancuso, M., and A. Evenden. 1996. Establishment record for Mount Harrison Research Natural Area within Sawtooth National Forest, Cassia County, Idaho. Unpublished report. Idaho Department of Fish and Game, Conservation Data Center, Boise, Idaho.

- Mancuso, M., and L. Kinter. 2006. Monitoring control of smooth brome (*Bromus inermis*) within the Christ's Indian paintbrush (*Castilleja christii*) populations at mount Harrison, Sawtooth National Forest, Idaho. Prepared by Mancuso Botanical Services for U.S. Fish and Wildlife Service, Snake River Fish and Wildlife Office and Idaho Conservation Data Center. 20 pp. plus appendices.
- Mancuso, M., and L. Kinter. 2007. Monitoring control of smooth brome (*Bromus inermis*) within the Christ's Indian paintbrush (*Castilleja christii*) populations at mount Harrison, Sawtooth National Forest, Idaho. Prepared by Mancuso Botanical Services for U.S. Fish and Wildlife Service, Snake River Fish and Wildlife Office and Idaho Conservation Data Center.
- Moseley, R.K. 1993. The status and distribution of Christ's Indian paintbrush (*Castilleja christii*) and Davis' wavewing (*Cymopterus davisii*) in the Albion Mountains, Sawtooth National Forest and City of Rocks National Reserve. Prepared by the Idaho Department of Fish and Game's Conservation Data Center, Boise, Idaho. 18 pp.
- Moseley, R.K. 1996. Christ's Indian paintbrush (*Castilleja christii*) monitoring on the Sawtooth National Forest: transect establishment and baseline data. Prepared by the Idaho Department of Fish and Game's Conservation Data Center, Boise, Idaho. 16 pp.
- Moseley, R.K. 1998. Christ's paintbrush monitoring on the Sawtooth National Forest: third-year results. Prepared by the Idaho Department of Fish and Game's Conservation Data Center, Boise, Idaho. 10 pp.
- Moseley, R. and H. Hudak. 1994. Conservation strategy for *Castilleja christii* (Christ's Indian paintbrush). Prepared by the Idaho Department of Fish and Game and the Sawtooth National Forest for the Idaho Department of Parks and Recreation, Boise, Idaho.
- Motychak, J. and K. Pierson. 2005. A ten year summary of monitoring Christ's Indian Paintbrush (*Castilleja christii*) on Mount Harrison, Sawtooth National Forest (1995-2005). Unpublished report, prepared for the U.S. Forest Service, Sawtooth National Forest, Twin Falls, Idaho. 18 pp.
- Pierson, K. 2004. Christ's Indian paintbrush (*Castilleja christii*) – Candidate Notice of Review (CNOR) 2004 update. U.S. Sawtooth National Forest. Received May 31, 2004. 2 pp.
- Pierson, K. 2007. Preliminary monitoring data for *Castilleja christii* for 2006. Unpublished data Sawtooth National Forest, 9 pages.
- Pierson- Motychak, K. and J. Motychak. 2010. Conservation Successes for a Rare Idaho Endemic: Results of a Conservation Agreement and Botanical Special Interest Area Establishment for Christ's Indian Paintbrush. In Prep.

- Shenk G. and K. Holsinger. 2001. *Castilleja coccinea* (L.) Sprengel (Indian Paintbrush conservation and research plan). New England Wildflower Society, Framingham, Massachusetts. 18 pp.
- Shultz, J.S. 1980. Botanical survey of the Burley Ranger District with special emphasis on plant species proposed for listing as threatened or endangered, Sawtooth National Forest: Black Pine, Sublette, Raft River, Albion Mountains Divisions. Unpublished report. Sawtooth National Forest, Twin Falls, ID. 41 p.
- (USDA) NRCS Plants Database. 2010. Last accessed April 22, 2010. <http://plants.usda.gov>
- (USFS) U.S. Forest Service. 2002. Conservation assessment and strategy for *Castilleja christii*, Christ's Indian paintbrush. Prepared by the U.S. Forest Service, Sawtooth National Forest, Twin Falls, Idaho. April 2002. 55 pp.
- (USFS) U.S. Forest Service. 2003. Sawtooth National Forest land and resource management plan. Intermountain Region, Twin Falls, Idaho. Pages III-1 – III-93, III-270, III-280, and III –288.
- (USFS) U.S. Forest Service. 2007. *Castilleja christii*, Candidate Conservation Agreement Report 2005-2006 prepared by Kim Pierson, Dena Santini and Deb Taylor. U.S. Forest Service, Sawtooth National Forest, Twin Falls, Idaho. Appendix 1, Smooth Brome Treatment Methods, Treatment areas and Discussion for 2006 22 pp plus Appendix.
- (USFS) U.S. Forest Service. 2009. Draft *Castilleja christii*, Candidate Conservation Agreement Report 2005, 2006, 2007, & 2008 and preliminary 2009 data. U.S. Forest Service, Sawtooth National Forest, Minidoka Ranger District. 30 pages.
- (USFS) U.S. Forest Service. 2010. Draft *Castilleja christii*, Candidate Conservation Agreement Report 2005, 2006, 2007, 2008, and 2009 and preliminary 2010 data. U.S. Forest Service, Sawtooth National Forest, Minidoka Ranger District. 31 pages.
- (USFS and USFWS) U.S. Forest Service and U.S. Fish and Wildlife Service. 2005. Candidate Conservation Agreement for *Castilleja christii*, Christ's Indian paintbrush. U.S. Forest Service, Minidoka Ranger District, Sawtooth National Forest, Twin Falls and Burley, Idaho. 60pp.
- (USFWS) U.S. Fish and Wildlife Service. 1995. Conservation agreement for *Castilleja christii*. Prepared by the Snake River Basin Office, Boise, Idaho and signed by the Service and the U.S. Forest Service, Sawtooth National Forest, Twin Falls, Idaho (dated 9/25/95).
- (USFWS) U.S. Fish and Wildlife Service. 2009. Spotlight species action plan for *Castilleja christii*. Idaho Fish and Wildlife Office, Boise, Idaho. 4 pp.



### Personal Communications

- Colket, Beth. 2009. Botanist, Idaho Department of Fish and Game. Boise, ID. Phone conversation with Jason Pyron, USFWS. April 14, 2009.
- Egger, J. Mark. 2008. Research Associate, University of Washington Herbarium. Subject: examination of possible hybrid specimens. Dated March, 28 2008.
- Kinter, Lynn. 2007. Botanist, Idaho Natural Heritage Program, Idaho Department of Fish and Game, Boise, Idaho. Subject: comments on the threats section of the 2005 candidate notice of review. Dated March 2, 2007.
- Phillips, Lucas. 2009. Rangeland Management Supervisor. U.S. Forest Service, Sawtooth National Forest, Minidoka Ranger District. Burley, ID. Phone conversation with Jason Pyron, USFWS. April 13, 2009.
- Pierson, Kim. 2001. Botanist, USDA Forest Service, Sawtooth National Forest, Twin Falls, Idaho. Subject: Personal observation of pollinators. Date: August 11, 2001. 1 p.
- Pierson, Kim. 2010. Botanist, U.S. Forest Service, Sawtooth National Forest. Twin Falls, ID. Email: Comments on draft 2010 *Castilleja christii* candidate notice of review. Dated April 19, 2010.
- Tepedino, Vince. 2002. Researcher, USDA Agricultural Research Service, Bee Biology and Systematics Laboratory, Department of Biology, Utah State University, Logan, Utah. Subject: Bee pollinators found on Mount Harrison. Dated August 5, 2002.
- USDA Forest Service. 2003. Sawtooth National Forest land and resource management plan. Intermountain Region, Pages III-1 – III-93, III-270, III-280, and III – 288.

### *In Litteris*

- (USFS) U.S. Forest Service. 2008. Smooth brome treatment methods, treatment areas, and discussion for 2007. Presented at February 21, 2008, coordination meeting.
- Kinter, Lynn. 2010. Botanist, Idaho Natural Heritage Program, Idaho Department of Fish and Game, Boise, Idaho. Subject: comments on the 2007 and 2008 smooth brome monitoring conducted by the INHP. Dated March 11, 2010.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Cowlyall Bohan 5/18/10  
Regional Director, Region 1, Fish and Wildlife Service Date

Goran W. Gould  
ACTING  
Director, Fish and Wildlife Service October 22, 2010

Concur:

Do not concur: \_\_\_\_\_  
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review:

Conducted by: Karen Colson Date: May 4, 2010  
Botanist

Reviewed by: Kendra Womack Date: May 4, 2010  
Supervisory Fish and Wildlife Biologist

Steve Duke Date: May 4, 2010  
Assistant Field Supervisor

Gary L. Burton Date: May 4, 2010  
Acting State Supervisor, Idaho FWO